



# **Kentucky Department of Fish and Wildlife Resources**

## **Annual Research Highlights, 2007**

**Volume I, July 2008**



## **Our Mission:**

*To conserve and enhance  
fish and wildlife resources  
and provide opportunity for  
hunting, fishing, trapping,  
boating and other  
wildlife related activities.*

---

**Kentucky Department of Fish and Wildlife Resources**

# Foreword

---

The Kentucky Department of Fish and Wildlife Resources (KDFWR) understands the importance of long-term planning to protect and manage the natural resources of the Commonwealth and to effectively serve hunters and fishermen in Kentucky. Over the past two years, KDFWR has collaborated with multiple outside agencies, non-profit organizations, professionals, and biologists to complete two important planning documents: the Comprehensive Wildlife Conservation Strategy (completed in 2007; <http://fw.ky.gov/kfwis/stwg/>) and the 2008 – 2012 Kentucky Department of Fish and Wildlife Resources Strategic Plan (<http://fw.ky.gov/pdf/strategicplan2008-2012.pdf>). Both of these documents are designed to guide agency decisions; however, they serve two unique purposes. The Comprehensive Wildlife Conservation Strategy (CWCS) is Kentucky's roadmap for sustaining fish and wildlife diversity. The two primary goals of the CWCS are to identify and prioritize important species and habitats of conservation concern within Kentucky and to successfully implement conservation measures for these species and habitats. In contrast, the 2007 – 2012 Strategic Plan addresses both fish and wildlife management issues and agency issues as a whole.

The five primary goals of the Strategic plan are:

- 1) To conserve and enhance fish and wildlife populations and their habitats;
- 2) To increase opportunity for, and safe participation in hunting, fishing, trapping, boating, and other wildlife-related activities;
- 3) To foster a more informed and involved public;
- 4) To expand and diversify our user base and
- 5) To create a more diverse, effective, and efficient organization.

These new documents are available to the public, and are intended for frequent revision and re-adjustment to incorporate ever changing agency and public needs and interests. The 2007 Kentucky Department of Fish and Wildlife Resources Research Summary represents our targeted efforts to fulfill the goals of our Comprehensive Wildlife Conservation Strategy as well as Goal 1 of the 2008 – 2012 Strategic Plan. These project summaries serve as a testament to KDFWR's vigilance in the conservation of the fish and wildlife resources that we hold in trust for the public.

The Kentucky Department of Fish and Wildlife Resources receives no general fund taxpayer dollars. As a result, the Department relies on hunting and fishing license fees, boat registration fees, and federal programs. Projects that are entirely funded by the state are labeled "non-federal aid" (NFA); however, most of the projects included in this document are partially or fully funded by federal programs such as the State and Tribal Wildlife Grant Program, the Wildlife Restoration Act (Pittman-Robertson), the Sport Fish Restoration Program (Dingell-Johnson), the

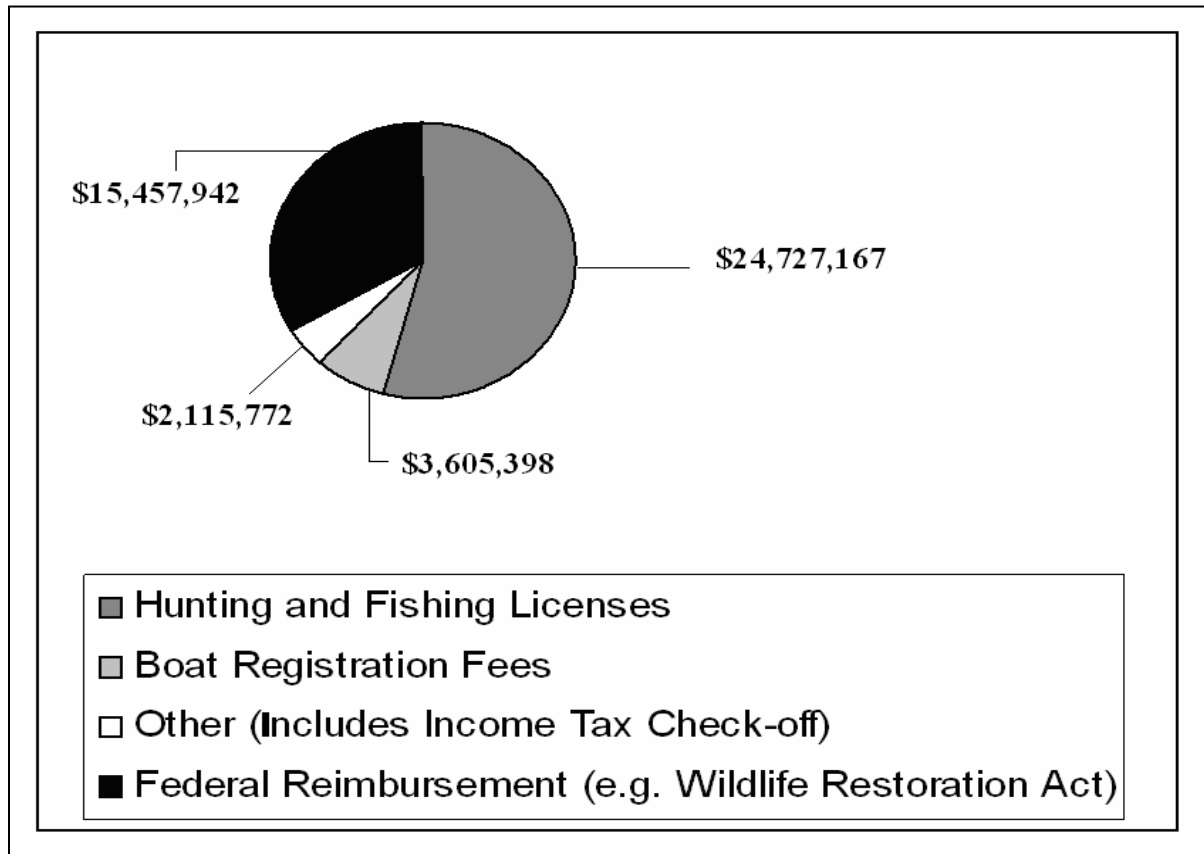
Landowner Incentive Program (LIP), and the Cooperative Endangered Species Conservation Fund (Section 6).

These federal programs serve a variety of purposes; however, each has an underlying goal of fish, wildlife, and/or habitat conservation. Brief descriptions of each of these programs are as follows:

<b>Federal Funding Source</b>	<b>Program Goal</b>
State Wildlife Grant Program (SWG)	To develop and implement programs that benefit wildlife and their habitats, specifically species and habitats of conservation concern
Wildlife Restoration Act (Pittman-Robertson)	To restore, conserve, manage and enhance wild birds and mammals and their habitats
Sport Fish Restoration Program (Dingell-Johnson)	To fund fishery management projects, boating access, and aquatic education
Landowner Incentive Program (LIP)	To protect and restore habitats on private lands to benefit species of conservation concern
Cooperative Endangered Species Conservation Fund (Section 6)	To fund conservation projects for candidate, proposed, or listed species.

These federal programs provided approximately 15.5 million dollars to KDFWR in 2007 (see funding chart). For reference, we have included the state and federal funding sources for each project; however, these projects may be additionally supplemented by outside funding provided by non-profit organizations or universities. When possible, we listed these sources in addition to the state and federal funding sources. For each project summary, we also identify the specific goals of the strategic plan or CWCS fulfilled, as well as the KDFWR contact responsible for each project.

**Fig. 1. Kentucky Department of Fish and Wildlife Resources Funding Sources 2007**



Please use the following citation when referencing this document:

**Kentucky Department of Fish and Wildlife Resources Annual Research Highlights, 2007. Publication of the Wildlife and Fisheries Divisions. July, 2008, 90 pp.**

# Table of Contents

## Section One: Research Summaries

Assessing <b>Elk</b> Abundance and Distribution in Eastern Kentucky using FLIR (Forward-Looking Infrared).....	10
<b>Black Bear</b> Resource Selection in Eastern Kentucky.....	11
Colonization of the <b>Black Bear</b> in Eastern Kentucky: Conflict and Tolerance Between People and Wildlife.....	13
Determination of <b>Bat</b> Species Within Interior Forested Areas Using Anabat II Systems and Mist-Netting in Daniel Boone National Forest.....	15
Development of a Bivalve Diet For Use in Early Stage Juvenile <b>Freshwater</b> <b>Mussel</b> Culture.....	17
Distribution, Population Status and Habitat Characteristics of the <b>River Otter</b> ( <i>Lontra canadensis</i> ) in Kentucky.....	18
Ecological and Behavioral Interactions Between Golden-Winged and Blue-Winged Warblers in Eastern Kentucky.....	20
Estimating <b>Black Bear</b> Populations in Kentucky.....	21
Meningeal Worm ( <i>Parelaphostrongylus tenuis</i> ) Infection Rate and Effects on Survival of Reintroduced <b>Elk</b> ( <i>Cervus elaphus nelsonii</i> ) in Kentucky.....	22
<b>Palezone Shiner</b> Status Survey and Habitat Delineation.....	24

## Section Two: Research Highlights 2007-2008

### Wildlife

#### Big Game

Assessment of Reproductive Output for White Tailed Deer in Kentucky.....	26
Chronic Wasting Disease Surveillance in Kentucky.....	27

#### Migratory Bird Program

Avian Influenza Monitoring throughout Kentucky.....	28
Migratory Shorebirds, Colonial Water Bird, and Woodcock Investigations.....	29
Monitoring and Management of Kentucky's Waterfowl.....	30
Monitoring Giant Canada Goose Populations in Kentucky.....	31
Mourning Dove Banding in Kentucky.....	32
Nest Surveys for the Interior Least Tern in Kentucky.....	33
Proactive Wood Duck Management in Kentucky.....	34

#### Small Game Program and Turkey

A New Approach to Mast Surveys in Kentucky.....	35
Monitoring Efforts for Northern Bobwhite Populations in Kentucky.....	36
Wild Turkey Reproduction in Kentucky.....	38

#### Wildlife Diversity

##### Amphibians and Reptiles

Inventory, Monitoring, and Management of Amphibians and Reptiles in Kentucky.....	39
---	----

### Bats

Cave Protection and Monitoring of Federally Listed Bat Species in Kentucky.....	40
Identifying and Protecting Hibernation Roosts for Endangered Bats in Kentucky.....	41

### Birds

Assessing Avian use of land enrolled in Conservation Practice 33 (CP33), Conservation Reserve Program.....	42
Assessing Raptor Populations of Peabody Wildlife Management Area and Throughout Kentucky.....	43
Cooperative Cerulean Warbler Forest Management Project.....	44
Monitoring Priority Songbird Populations.....	45
Population Status and Reproductive Success of the Bald Eagle in Kentucky.....	46
Population Status and Reproductive Success of the Peregrine Falcon in Kentucky.....	47
Vocalizations of adult Turkey Vultures as they Arrive at Nest Sites during the Nesting Season.....	48

### Mollusks

Development of In Vitro (artificial) Laboratory Culture Methods for Rearing Juvenile Freshwater Mussels.....	49
Endangered Species Recovery in Kentucky: Restoring the Freshwater Mussel via Population Augmentation.....	50
Evaluating the Present Status of Mussel Resources in Kentucky: Quantitative and Qualitative Survey and Monitoring Efforts.....	51

## Exotic Species Control

An Investigation of Herbicide Treatments to Eradicate Autumn Olive on Taylorsville Lake Wildlife Management Area.....	52
Sericea Lespedeza Control on Peabody Wildlife Management Area.....	53
Use of Rodeo Herbicide to Control <i>Phragmites australis</i> on Peabody Wildlife Management Area.....	54
Using Varying Frequencies of Prescribed Fire in Combination With Herbicide Applications to control Sericea Lespedeza on Peabody Wildlife Management Area.....	55

## Fishes

A Survey of Fishes in Terrapin Creek, Kentucky.....	56
Conservation Status and Habitat of the Longhead Darter in Kinniconick Creek, Lewis County Kentucky.....	57
Databasing and Geo-Referencing Fish Collection for Kentucky.....	58
Distribution, Habitat, and Conservation Status of Ichthyofaunal Species of Greatest Conservation Need.....	59
Evaluation of a 12.0-in Minimum Size Limit on Channel Catfish in Kentucky's Small Impoundments.....	60
Evaluation of a 15-20 Inch Protective Slot Limit and 5 Fish Creel Limit on Rainbow Trout in the Lake Cumberland Tailwater.....	61
Evaluation of a 40-Inch Muskellunge Minimum Length Limit at Buckhorn Lake.....	62
Evaluation of Kentucky's Largemouth Bass Stocking Initiative.....	63
Evaluation of the Growth of Two Different Stocking Sizes of Blue Catfish Stocked into Three North Central Kentucky Small Impoundments.....	64

Evaluation of Trophy Brown Trout Regulations and Stocking Strategies in the Lake Cumberland Tailwater.....	65
Evaluation of White Bass Stocking to Enhance Existing Reservoir Populations.....	66
Impacts of Spawning Habitat Manipulations on Largemouth Bass Year-Class Production in Meldahl Pool, Ohio River.....	67
Investigation of the Restoration of Native Walleye in the Upper Barren River.....	68
Investigation of the Walleye Population in the Rockcastle River and Evaluation Of Supplemental Stocking of Native Strain Walleye.....	69
Lake Sturgeon Restoration in the Upper Cumberland River System.....	70
Life History and Population Status of the Blacktail Redhorse in Terrapin Creek, Graves County, Kentucky.....	71
Monitoring and Management of Ohio River Sport Fisheries.....	72
Monitoring Trends in Black Bass Fisheries.....	73
Ohio River Largemouth Bass Supplemental Stocking Study.....	74
Preliminary Assessment of a Newly Established Blue Catfish Population in Taylorsville Lake.....	75
Preliminary Assessment of Bluegill and Redear Sunfish Populations in Small Impoundments.....	76
Relationships Between Primary Productivity and creation of a Trophy Largemouth Bass Fishery: Monitoring and Management of Cedar Creek Lake.....	77
Taxonomic Resolution, Life History, and Conservation Status of the Undescribed “Sawfin” Shiner and Kentucky Arrow Darter.....	78
The Use of Flathead Catfish to Reduce Stunted Fish Populations in a Small Kentucky Impoundment.....	79
Urban Fishing Program in Kentucky.....	80
Using GIS-based Technology for Aquatic Conservation in the Upper Green River Drainage, Kentucky.....	81

## Habitat Restoration

Direct Seeding of Shrubs/Brambles on Reclaimed Mine Ground on Peabody Wildlife Management Area.....	82
Evaluation of Warm Season Grass Thinning Treatments on Green River Wildlife Management Area: Spring Disking, Glyphosate, and Select Herbicides.....	83
Grassland Management and Restoration in Kentucky.....	84
Impacts of Herbicide Application Following a Late Summer Burn, KDFWR Headquarters.....	85
Maximizing Wildlife Habitat and Cattle Production on T.N. Sullivan Wildlife Management Area.....	86
Mill Branch Stream Restoration Project, Knox County, Kentucky.....	87
Native Warm Season Grass Suppression Treatments in Harrison County.....	88
Quail Unlimited Warm Season Grass Test Plot Project on Kentucky River Wildlife Management Area.....	89
Shorebird Management Unit Creation and Invasive Willow Control.....	90

## Wildlife Damage

Use of Temporary Electric Fencing to Eliminate Deer damage to Sunflower Plantings on the Blue Grass Army Depot.....	91
---	----

<b>Project Contact List.....</b>	<b>92</b>
----------------------------------	-----------



# Section One: Research Summaries

**The projects included in this section are completed or are nearing completion; consequently, management recommendations are addressed.**

## Assessing Elk Abundance and Distribution in Eastern Kentucky Using FLIR (forward-looking infrared)

*Lauren Dahl, John Cox, David Maehr and Will Bowling, University of Kentucky; Joe Duchamp and Jeffery Larkin, Indiana University of Pennsylvania; David Unger, Alderson Broaddus College; Karen Alexy and Tina Brunjes, KDFWR.*



*Elk calf/Wes McFadden*

The successful restoration and subsequent population growth of elk (*Cervus elaphus*) in Kentucky during the past decade has created unique population monitoring challenges for wildlife managers. Restricted ground accessibility, elk avoidance of humans, and a predominately forested landscape make traditional ungulate population estimation techniques impractical in Kentucky's elk restoration zone.

This research focuses on testing the feasibility of FLIR (forward-looking infrared) to survey the Kentucky elk population. FLIR uses an infrared scope

mounted to the underside of an aircraft which is flown over the study area recording radiation emissions from heat sources. Animals are identified and distinguished by the FLIR scope operator and a GPS location is recorded.

The general survey was conducted during December 2006 and covered approximately 41,000 hectares surrounding the original 8 release sites. To test the rate that FLIR is able to detect elk, a study was conducted in December 2006 and December 2007 that compared collared elk locations to elk locations identified by FLIR. By comparing these locations we can determine if FLIR detected the collared animals, thereby obtaining a detection rate. Ultimately, elk detection rates and habitat characteristics associated with elk locations obtained during the survey are used to build a model that will allow estimation of elk abundance and distribution.

**Management Recommendations:** The elk population estimate derived from this study will allow managers to identify elk abundance and distribution patterns in eastern Kentucky. This will be important in determining how hunter harvest tags should be distributed within the newly formed Elk Hunting Units. Not only do managers need to know how many animals should be harvested from each unit, but how these animals are distributed. The distribution of elk determines how many hunters can equitably hunt in a specific Elk Hunting Unit without being heavily concentrated in one area. The information derived from this elk population model may also be used as a reference in the creation of a more fine scale habitat suitability model.

We are also working on findings that will help make decisions on the future use of FLIR for wildlife surveys. We used FLIR on elk as well as black bears. The detection rate for each species, the ability of FLIR to correctly identify species and experiences gained throughout this project will be collected to help managers understand FLIR limitations and benefits.

**Funding Source:** Pittman-Robertson Funds (PR), Turner Foundation, United States Department of Agriculture, and Rocky Mountain Elk Foundation.

**KDFWR Strategic Plan. Goal 1, Strategic Objective 5b.**

## Black Bear Resource Selection in Eastern Kentucky

*Ben Augustine and David Maehr, University of Kentucky; David Unger, Alderson Broaddus College; John Cox, University of Kentucky; Jeffery Larkin, Indiana University of Pennsylvania. **KDFWR Contact:** Steven Dobey.*

After being extirpated from Kentucky in the late 19<sup>th</sup> century, the black bear (*Ursus americanus*) has expanded its range back into the state and the population may still be increasing in both size and range. Previous and ongoing research conducted by the University of Kentucky and Indiana University of Pennsylvania has documented the current range of the black bear in southeast Kentucky and successful reproduction has been confirmed in 3 counties—Bell, Harlan, and Letcher. While based on limited data, this population has demographic rates similar to those of other bear populations in the Southern



*Black bear/David Unger*

Appalachians and likely represents a source for further range expansion. The increasing presence of black bears on the eastern Kentucky landscape presents new challenges for wildlife managers, conservation organizations, and residents, alike.

Appropriate management decisions will require detailed information on demographic rates, resource use, movement patterns, and landscape connectivity. The configuration, amount, and quality of black bear habitat will determine the number of bears Kentucky can support. Movement patterns and landscape connectivity will determine how bears will move through the landscape and which areas of suitable habitat are available for population expansion. Habitat configuration and connectivity influence how bears traverse the landscape, raising implications for human-bear interactions and ultimately, cultural carrying capacity.

Research conducted by the University of Kentucky has focused on these issues by monitoring demographic rates and collecting fine-scale location data via GPS collars. Since 2003, 27 litters have been documented and 50 cubs have been handled. The 2008 den season was the most productive to date with 11 litters and 27 cubs. Research-related bear captures are also increasing with 27 bears captured in the summer of 2007 and GPS data are being collected at an increasing rate. Twenty-four bears have worn GPS collars since 2002, with 12 being deployed in the past year and 20 to be deployed this summer. As high resolution GPS data are accumulated, a much more detailed description of habitat use and movement patterns will emerge.



**Management Recommendations:** While this population appears to be increasing in both size and range, the future of the black bear in Kentucky is uncertain. The increasingly fragmented landscape of eastern Kentucky poses many challenges to the persistence and expansion of the black bear population. Anthropogenic barriers such as roads and surface mines may limit range expansion as well as increase mortality rates. Continued study of demographic rates, resource use, and movement patterns are needed to better understand how black bears will use the eastern Kentucky landscape in the future and which management policies will best promote a healthy black bear population while minimizing human-bear conflicts.



*Black bear telemetry/David Maehr*

**Funding Source:** Pittman-Robertson Funds (PR)

**Comprehensive Wildlife Conservation Strategy: Appendix 3.2; Class Mammalia: Priority Research Project #1.**

## Colonization of the Black Bear in Eastern Kentucky: Conflict and Tolerance Between People and Wildlife

*Hannah Harris and David Maehr, University of Kentucky*

**KDFWR Contact:** *Steven Dobey.*



*Black bear/KDFWR*

The black bear (*Ursus americanus*) has returned to Kentucky and there is a reproducing and expanding population in the southeastern region of the Commonwealth. However, abundant anthropogenic food resources are bringing bears into conflict with humans and these artificial attractions have the potential to alter bear behavior, territory use, reproduction, and physiology. If animals are poached or killed because

of a perceived threat, or must be euthanized because of repeated nuisance activity, there could be a substantial impact on this recolonizing population. In addition, conflict with the bear is likely to increase negative sentiment and make the public less supportive of its restoration.

The broad goal of this project was to document the extirpation and recent return of the black bear to eastern Kentucky and to examine the interactions of bears with local residents, with the ultimate result of improving management of nuisance bears and increasing the knowledge and understanding regarding bears of tourists and Kentucky residents. Using 52 formal and informal interviews of regional stakeholders, participant observation, and media reports collected between the summer of 2003 and fall of 2006, we examined the ways in which the presence of the black bear in Harlan and Letcher Counties (near the cities of Cumberland, Benham, and Lynch) had an impact on area residents and how their views appeared to be affecting the success of the bears' re-colonization. We also explored the motivations and interests of the people that visit Kingdom Come State Park to see bears and their perceptions about wildlife in the area. We complemented the information regarding public opinion of bears with research into the ways in which anthropogenic food resources and attractants changed bear behavior in eastern Kentucky. These data were analyzed using NVivo qualitative analysis software to assess and evaluate trends and attitudes among project participants.

Bear/human conflicts typically occurred in heavily used areas where people were feeding or attempting to touch bears drawn in by food availability or when bears attempted to access garbage, food stored inappropriately by campers, or other food sources (like pet and livestock feed) left outdoors. Nearly all conflict between people and bears was precipitated by attempts at inappropriate food acquisition on the part of the bear. Once the bears were conditioned to unnatural foods it was very difficult to change their behavior even using negative conditioning or relocation.



Although local residents interviewed were not unanimously in favor of the bears, the level of community-based tourism and investment in the region was unusually high and even the issues of human-bear conflict are not so deeply contentious that dialog was impossible. Overall, participants indicated support for the bears. The city of Cumberland has declared itself “The Bear Capital of Kentucky” and installed new signs at most public buildings to this effect. Local residents, together with the Kentucky Department of Fish and Wildlife Resources and University of Kentucky researchers, formed a bear task force to deal with bear-related issues and in May 2004 the Cumberland Chamber of Commerce put on the first annual Black Bear Festival.

**Management Recommendations:** An understanding of the human dynamics and cooperation taking place in this situation helps provide much-needed information for other localities where people are struggling to co-exist with wildlife, so that wildlife can be seen not as a threat but as a beneficial communal resource. Furthermore, it is evident that a need exists for strategic and intense bear education programs directed at every age and socio-economic class in the Appalachian Mountains in Kentucky.



*Black bear /KDFWR*

**Funding Source:** Pittman-Robertson Funds (PR)

**Comprehensive Wildlife Conservation Strategy: Appendix 3.4. Class Mammalia:  
Priority taxa-specific conservation action #3.**

## Determination of Bat Species Within Interior Forested Areas Using Anabat II Systems and Mist-Netting in Daniel Boone National Forest

Brooke Slack, KDFWR; Charles Elliott, Eastern Kentucky University

Direct capture with mist nets and passive acoustical monitoring using ultrasonic detectors are methods which have been used to survey bat activity for decades. Recent research has compared these two methods in areas of high bat activity known as flight or foraging corridors. Although several bat surveys have incorporated direct and passive sampling in corridors, none have compared the two methods simultaneously in interior forested areas lacking a corridor. In these areas, mist nets are not effective and ultrasonic detection may provide a more accurate representation of species present. The objective of this study was to compare the effectiveness of both methods in sampling bat communities within interior forested areas. The study was located on the Daniel Boone National Forest, Laurel County, KY and consisted of pre-selected study units. In each study unit, bat activity was simultaneously monitored using both methods from May through August in 2006 and 2007



Anabat system / Brooke Slack

for two consecutive nights per month. A total of 96 nights of sampling were completed for each method. Four species were acoustically detected: eastern red bat (*Lasiurus borealis*), eastern pipistrelle (*Pipistrellus subflavus*), northern long-eared (*Myotis septentrionalis*), and big brown bat (*Eptesicus fuscus*). Four species of bats were mist-netted: northern long-eared bats, big brown bats, eastern red bats, and one evening bat. At sites where bats were both detected and netted, the acoustical systems consistently detected more species than were captured by mist nets. The use of both methods is strongly recommended for determining presence of a bat species in future studies and surveys. Acoustical sampling should not be used in cluttered habitats for sampling purposes since bat calls change when navigating through vegetation compared to open areas or open corridors.

**Management Recommendations:** Habitat is the primary factor in determining what type of bat sampling method to employ. Mist-nets are most effective in closed canopy forested corridors while acoustical monitoring systems such as Anabat are productive in more open areas. Interior forested areas, however, can prove difficult to effectively sample with either method. These areas do not have corridors and are typically "cluttered" with understory herbaceous vegetation, young, second growth vegetation, and branches of larger, canopy trees. Both methods are severely impacted by clutter.



In this study, mist-nets only captured bat species which are known to forage in less open areas, such as northern long-eared bats (*Myotis septentrionalis*). The cone of detection in Anabat became distorted when it came into contact with an obstruction such as vegetation. Although both methods produced a species the other method did not, neither method provided an accurate representation of the bat community. Echolocation calls recorded in cluttered habitat should be analyzed with caution as they are typically not search phase calls. Therefore, the call structure of bat species such as the red bat (*Lasiurus borealis*) can appear similar to other species. This can lead to misidentification and underrepresentation of bat species. The use of Anabat should be limited to open areas such as fields, large water bodies, and large stream corridors.



*Indiana Bat/John MacGregor*

**Funding Source:** State and Tribal Wildlife Grants (SWG)

**Comprehensive Wildlife Conservation Strategy: Appendix 3.2, Class Mammalia:  
Priority Survey Project #1.**



## Development of a Bivalve Diet for Use in Early Stage Juvenile Freshwater Mussel Culture

Fritz Vorisek, University of Kentucky; Monte McGregor, KDFWR



Algae culture / Monte McGregor

Modern day threats to mussels include habitat destruction from a variety of factors including: sedimentation from agricultural land, logging and mining operations, construction projects, stream channelization and dredging, toxic spills (oil, gas, industrial acids, pesticides, fertilizers) and resulting fish kills, and invasion from exotic species. With continuing population declines, protecting each stage in the life cycle of the mussel becomes critical. Life history stages include the production of larvae, host fish attachment and development, and juvenile/adult survival. Suitable hosts must be present in adequate numbers to increase the chance of “catching” mussel larvae, and

sufficient habitat must also be present for grow-out of juveniles to the adult stage. Furthermore, good water quality is critical to all stages of development, especially for the larval and juvenile stages. In recent years, mussel propagation research has targeted the juvenile stage, especially in the development of hatchery conditions for culture and grow-out of mussels. However, limited information is available on the nutritional requirements for many of Kentucky’s mussels. The goal of this project is to focus on culture and propagation of common, rare and/or endangered mussels using fish hosts in open/closed aquaculture systems, and to compare growth and survival of juveniles in various experimental juvenile nursery environments (e.g., filtered-heated, filtered-unheated, unfiltered unheated). Throughout 2007, we refined techniques for culturing algae species in a laboratory setting, and we set-up controlled experiments, using different food sources (four algae species) to determine which algae species is optimally suitable for the Painted Creekshell (*Villosa taeniata*) diet. In addition, we set up experiments to compare the efficacy of native algal and sediment diets versus cultured algal diets using the Plain Pocketbook (*Lampsilis cardium*). We plan to analyze results of these experiments in 2008 and continue investigating optimal diets for use in early stage juvenile freshwater mussel culture.

**Management Recommendations:** By conducting controlled experiments to assess growth and survival of juvenile mussels in various experimental nursery environments, we will be able to efficiently manage resources to optimize the captive rearing of several mussel species, including many that are of conservation concern. The results of this project will ultimately be incorporated into rearing protocols at the Center for Mollusk Conservation.

**Funding Source:** U.S. Fish and Wildlife Service

**Comprehensive Wildlife Conservation Strategy: Appendix 3.2, Class Bivalvia: Priority Research Project #3.**

## Distribution, Population Status and Habitat Characteristics of the River Otter (*Lontra canadensis*) in Kentucky

*Erin Barding and Michael Lacki, University of Kentucky.*

**KDFWR Contact:** *Laura Patton.*



*River otter / Tim Knight*

In an effort to restore self-sustaining populations of otters throughout suitable habitat in Kentucky, KDFWR released 355 otters among 14 sites in the central and eastern part of the state during 1991-1994. Incidences of sightings and reports of nuisance otters have increased recently in areas where otters were reintroduced in the state, while the remnant population in the western portion of the state appears to be thriving. In 2004, an experimental harvest season was opened and limited to the Jackson Purchase in Kentucky. The high

frequency and quantity of reports of river otter occurrence and activity throughout the state continued and, in 2006, prompted KDFWR to implement a statewide trapping season with a bag limit of 6 otters per trapper. Increased frequency of sightings, incidental trappings, roadkills and complaints of nuisance otters throughout Kentucky during the past several years are likely indicative of increasing populations.

There has never been a comprehensive effort to research the Kentucky otter population before or after the reintroduction. Therefore, it is imperative to determine the status of the river otter throughout Kentucky in order to implement appropriate management strategies for this species in the state. The objectives of my research are to 1) determine the distribution and relative abundance of otters in Kentucky; 2) determine population demographics, including reproductive characteristics of otter populations in Kentucky based on analysis of carcasses provided by trappers; 3) describe food habits of river otters in Kentucky based on analysis of scat and stomach contents; 4) create habitat models for river otters in Kentucky based on riparian and landscape parameters measured during sign surveys; 5) test the Missouri river otter population model with Kentucky otter data and determine if this model is appropriate for Kentucky otters.

### *2007-08 Update*

The state was stratified according to 11 major watershed basins, and otter sign survey sampling intensity within each basin was proportional to the relative percentage of the state that each basin comprises. A total of 36 surveys were conducted from April to October 2007. Riparian and landscape measurements were collected during all field surveys, which will be used to create a predictive habitat model for otters in Kentucky. River otter sign (tracks, scats, slides, dens, etc.) was found in 6 of the 11 basins. When survey data is combined with trapping data, river otters were reported in every major basin in the state.

I have performed a total of 148 necropsies on trapper-donated river otter carcasses from the last 2 trapping seasons; 90 from the 2006-07 season and 58 from the 2007-08 season. To date, there have been signs of reproductive activity in over half of the females, pregnancies in 4 females, and I have recovered blastocysts in 14 females. Mean crown-rump length will be used to estimate the age of fetuses and implantation rates and parturition dates will be calculated.

### *Food habits*

Stomachs were removed from all otters and dissected to identify contents for the food habit analysis portion of this study. Frequency of occurrence (% of stomachs containing a prey item) and percent volume were calculated. To date, 124 stomachs have been dissected and the following have been found: 68% contain fish remains; 24% contain crayfish; 6% contain frogs, 1 contained remains of a snake, and 1 stomach contained remains of a bird. All remains are preserved and saved and I will attempt to identify crayfish exoskeleton remains and fish scales to the lowest possible taxonomic group.

**Management Recommendations:** The overall goal of this project is to provide KDFWR with a better understanding of the river otter population in Kentucky. This will assist KDFWR in determining if a statewide otter harvest is appropriate for Kentucky, and, if so, to designate suitable trapping zones and bag limits for the state to ensure both a sustainable harvest and healthy population of river otters in the state.

All survey, trapping, and capture per unit effort data will be compiled in order to create a comprehensive map of otter abundance and distribution throughout the state. In addition, a better understanding of the food habits of river otters in Kentucky may help diffuse complaints about sport fish population declines in the state (i.e., centrarchid spp.).

Predictive habitat models for river otters in Kentucky will be constructed based on riparian and landscape measurements and otter presence/absence data from field surveys. These models will enable any stream habitat in Kentucky to be evaluated to determine suitability for river otters. Population models for otters in Kentucky will be constructed based on reproductive measurements taken from carcass analysis including pregnancy rates and average litter sizes, mortality rates calculated from statewide harvest databases, and information gathered from trapper surveys and diaries. The model will predict and estimate population growth in the state, which will help determine if a regulated harvest is an appropriate management option for the entire state of Kentucky.



*River otter/John White*



*River Otters/David Olson*

**Funding Source:** Non Federal Aid (NFA)

**KDFWR Strategic Plan. Goal 1, Strategic Objective 5b.**



## Ecological and Behavioral Interactions between Golden-Winged and Blue-Winged Warblers in Eastern Kentucky

*David Westneat, David Maehr, Patricia Hartman, University of Kentucky; Jeff Larkin, Indiana University of Pennsylvania.*

**KDFWR Contact:** Shawchyi Vorisek

The golden-winged (*Vermivora chrysoptera*) and blue-winged (*Verminovra chrysoptera*) warblers are declining neotropical migrants of conservation concern that breed in eastern North America. Although these species were previously allopatric, human-caused landscape changes led to re-contact and subsequent hybridization within the last 150 years. Following re-contact, the golden-winged warbler has been steadily replaced by the blue-winged warbler across eastern North America. The golden-winged warbler is listed as a state-threatened species in Kentucky; consequently, an understanding of breeding behavior and habitat requirements, especially of factors influencing productivity and hybridization, are essential to effectively manage and conserve this species. Our overall project objective is to develop a conservation strategy for golden-winged and blue-winged warblers in eastern Kentucky. To do this, we will use a combination of field and molecular techniques to understand how demographic, habitat, and landscape characteristics influence species interactions and reproductive success of golden and blue-winged warblers.



*Golden Winged Warbler/Patricia Hartman*

During the two years (2006-2007) of this three-year project, we established study areas in southeastern Kentucky, and initiated efforts to band, collect blood from, and find nests of every adult within the study areas. Additionally, we collected behavioral data on conspecific and heterospecific interactions, including extra-pair events. Although both of our study sites were previously dominated by golden-wings, we observed a rapid invasion of hybrid and blue-winged warbler phenotypes in conjunction with golden-winged warbler declines. In the lab, we began paternity analyses of nests with known social parents to determine how hybridization occurs (whether through mixed social pairs or through heterospecific extrapair fertilization). We also optimized PCR conditions for >20 microsatellite primers, which we will use to examine population genetic structure and assess the level of nuclear mixing between golden and blue-winged warblers in Kentucky.

We will ultimately incorporate information on the habitat requirements and genetic structure of both species to develop future implementation projects necessary for the conservation of golden-winged and blue-winged warblers.

**Management Recommendations:** Basic life history information pertaining to nest-site selection and nest survival, brood parasitism, and source-sink population dynamics are limited throughout the golden-winged warbler's breeding range and are completely lacking in Kentucky; thus, these findings will provide site-specific management recommendations. Additionally, our findings will generate management recommendations for reclaimed minelands in eastern Kentucky, with emphasis on strategies that promote conservation of golden-winged warbler microhabitat and reduce the frequency of hybridization.

**Funding Source:** State and Tribal Wildlife Grant (SWG)

**Comprehensive Wildlife Conservation Strategy: Appendix 3.2, Class Aves: Priority Research Project #2. Priority Survey Project #5.**

## Estimating Black Bear Populations in Kentucky

David Maehr, *University of Kentucky*; Jeffery Larkin, *Indiana University of Pennsylvania*. **KDFWR Contact:** Steven Dobey.

Just thirty years ago the black bear (*Ursus americanus*) was considered to be extirpated from Kentucky. Today, its presence has been confirmed and it appears to be expanding its distribution throughout eastern Kentucky. In order to understand the dynamics of this expanding population, we sought to: estimate black bear population size in Kentucky's Cumberland Plateau physiographic region, use genetic analyses to determine the primary source population for the current Kentucky black bear population, and use existing data and baseline population estimates to model potential effects of harvest and other factors.



*Bear processing / David Maehr*

This work expands upon efforts to understand the demographic and spatial characteristics of the colonizing population, and findings will be important in understanding the Kentucky population as it relates to source populations in neighboring states. We employed hair snare traps throughout 2007 and collected 82 hair samples from two study areas (northeastern and southeastern Kentucky). Of these samples, 38 lacked sufficient material or contained too few guard hair roots to use in analysis. In total, we analyzed 50 hair samples from 27 individual bears (17 male and 10 females; determined using a sex-specific polymorphism in the amelgenin gene). We also obtained hair samples from biologists in Virginia, Tennessee, and West Virginia and began efforts to use genetic fingerprinting to identify each individual and assess genetic structure and corresponding relationships of geographic variation.

**Management Recommendations:** Upon completion of this project in 2008, the source population for Kentucky's colonizing black bears will be identified such that key landscape linkages may be conserved. Identifying important corridors and areas of connectivity are integral to managing and conserving Kentucky's expanding black bear population.

**Funding Source:** State and Tribal Wildlife Grants (SWG)

**Comprehensive Wildlife Conservation Strategy: Appendix 3.2; Class Mammalia: Priority Research Project #1.**

## Meningeal Worm (*Parelaphostrongylus tenuis*) Infection Rate and Effects on Survival of Reintroduced Elk (*Cervus elaphus nelsonii*) in Kentucky

Will Bowling and David Maehr, University of Kentucky; Karen Alexy, KDFWR; John Cox and Lauren Dahl, University of Kentucky; Dan Crank and Charlie Logsdon, KDFWR.

The Kentucky Department of Fish and Wildlife Resources (KDFWR), in collaboration with the University of Kentucky, engaged in elk (*Cervus elaphus*) calf capture during May and June 2007 as part of an ongoing meningeal worm (*Parelaphostrongylus tenuis*) study. A parasitic nematode that occurs naturally in eastern North America, meningeal worms have several distinct life stages. One of these life stages requires an ungulate host, a role normally fulfilled by white-tailed deer (*Odocoileus virginianus*). *P. tenuis* infections generally do not produce illness in white-tailed deer, but can cause severe neurological damage in other cervid species, including elk.

We captured 46 elk calves in 2007, from which we collected blood samples as well as general health indicators (weight, length, general condition). We also marked each animal with plastic ear tags, which will enable us to identify the individual later for additional blood sample collection. Our experimental design calls for subsequent blood collection from the study animals at approximately six months of age and at one-year intervals thereafter. Since this study began in 2004 we have collected initial blood samples from over 150 individuals. Blood samples are examined for *P. tenuis* antibodies through an enzyme-linked immunosorbent assay (ELISA), currently the most reliable antemortem meningeal worm test available.

In addition to collecting blood samples, we also deployed VHF radio-collars on all elk calves captured from 2004 to 2006. We tracked these study animals from May 2004 to August 2007. We conducted locations on each animal at least four times each week, dividing location times among diurnal, crepuscular, and nocturnal periods. The number of locations per individual is dependent on the length of time over which the animal was collared, battery life of the collar transmitter, and position of the animal in the landscape.

**Management Recommendations:** Preliminary results indicate that a significantly higher percentage of the population exhibits *P. tenuis* antibodies than are fatally afflicted by the nematode.



Elk calf / Wes McFadden



**Management Recommendations (cont.):** Thus, elk within the Kentucky population may be forming an early immune response to meningeal worm infection that could prevent *P. tenuis* associated mortalities. Managers may potentially utilize these data to determine the severity of risk meningeal worm infection poses to elk populations in Kentucky. We also hope to identify any correlations that exist between elk habitat use (derived from the radio-telemetry locations) and meningeal worm infection rates. Land managers could then utilize these correlations to pursue habitat management that will minimize the effects of meningeal worm infections.



*Elk/KDFWR*

**Funding Source:** Pittman-Robertson Funds (PR)

**KDFWR Strategic Plan. Goal 1, Strategic Objective 4c. Comprehensive Wildlife Conservation Strategy: Appendix 3.3; Priority Conservation Action #132.**

## Palezone Shiner Status Survey and Habitat Delineation

*Gabe Jenkins, KDFWR and Sherry Harrel; Eastern Kentucky University.*

The federally endangered Palezone Shiner (*Notropis albizonatus*) was most likely more widespread within the Tennessee and Cumberland River systems in the past, yet recent surveys have indicated two widely disjunct populations. One of these populations is found in the Little South Fork of the Cumberland River, Kentucky and the other is found in Paint Rock River, Tennessee River drainage, Alabama. Surveys of the Little South Fork throughout the past 20 years have indicated declining populations of *N. albizonatus*, and existing populations probably persist at low densities and are restricted to specific microhabitats within the system. The objectives of this project were to: 1) assess the population status of palezone shiners in the Little South Fork (including age-class structure, recruitment, and distribution) and; 2) assess changes in relative abundance of sympatric fish species.



*Palezone shiner/Gabe Jenkins*

Throughout 2006 and 2007, we sampled 44 sites, of those 44 sites, 10 sites were where the Palezone Shiner has been documented in the past. Each of these sites were approximately 100m in length and multiple seine-hauls were taken to sample all microhabitats. In total, we documented *N. albizonatus* at 30 of 44 sampled sites, and total number of *N. albizonatus* sampled was 1,519 (range 0 – 180 per site, while they ranked 12<sup>th</sup> in a previous survey conducted in 1999). The average Rapid Habitat Assessment scores for these sites indicated a supporting, but threatened, classification, though pollution factors (e.g. oil seeps, strip mining, logging immediately adjacent to stream) documented in 1999 were largely absent.

**Management Recommendations:** For the entire Little South Fork of the Cumberland River in Kentucky, we found increases in relative abundances of Palezone Shiners, especially in areas where they were considered to be rare. These increases indicate that conservation efforts to help protect the Palezone Shiner appear to be working. For continued recovery of *N. albizonatus* populations, we recommend the following management actions: 1) targeted cooperative agreements with landowners to fence cattle out of streams; 2) efforts to minimize local perturbations to the stream by vehicles (i.e. construction of proper stream crossings); and 3) continued efforts to maintain adequate riparian buffer zones to minimize siltation caused by logging, mining and other potentially damaging activities.

**Funding Source:** State and Tribal Wildlife Grants (SWG)

**Comprehensive Wildlife Conservation Strategy: Appendix 3.2, Class Actinopterygii: Priority Research Project #1 and Priority Survey Project #3.**